

-continued

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1.-38. (canceled)

39. A method comprising:

- (a) providing a plurality of circulating DNA molecules obtained from a patient sample;
- (b) ligating the circulating DNA molecules to cypher polynucleotides to form double-stranded cypher-target nucleic acid complexes, wherein:
 - (i) the cypher polynucleotides comprise identifier tags selected from a plurality of distinct identifier tag sequences;
 - (ii) at least two of the identifier tags are identical in sequence and are ligated to different circulating

DNA molecules, thereby non-uniquely tagging the different circulating DNA molecules; and

- (iii) an identifier tag alone or in combination with an end of a circulating DNA molecule uniquely identifies a cypher-target nucleic acid complex;
- (c) amplifying the cypher-target nucleic acid complexes to produce a corresponding plurality of cypher-target amplification products;
- (d) sequencing the cypher-target amplification products to produce a plurality of sequencing reads;
- (e) grouping the sequencing reads into groups, each of the groups comprising the same identifier tag sequence and the same circulating DNA end sequences, wherein each